

## PATENT ABSTRACTS OF JAPAN

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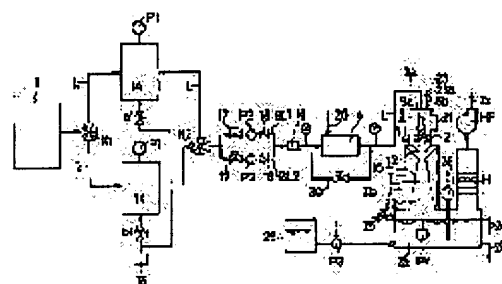
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(54) METHOD AND APPARATUS FOR MAKING SEMICONDUCTOR EXHAUST GAS HARMLESS

(57)Abstract:

PURPOSE: To stably and continuously treat harmful and explosive semiconductor exhaust gas in a low running cost by once sucking the exhaust gas from a semiconductor producing apparatus to introduce the same into vacuum space and gradually drawing out the exhaust gas from the vacuum space to subject the same to heat treatment.

CONSTITUTION: In a semiconductor producing apparatus such as a CVD apparatus, exhaust lines L are led out to be respectively connected to two vacuum tanks 14, 14 arranged in parallel. When raw exhaust gas 3a is introduced into a main vacuum tank 14 through the exhaust line L, the exhaust gas is diffused into the tank 14 to be diluted and an explosive component such as hydrogen or diborane and a component having strong toxicity such as arsine or phosphine become lower limits or less. When the exhaust gas is heated by a heater 4 through an outlet changeover valve K2, the oxygen-containing harmful oxidizing component in the raw exhaust gas 3a is reacted. By this method, effective treatment for making exhaust gas harmless is safely and inexpensively performed.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The semi-conductor exhaust gas damage elimination approach characterized by heating the exhaust gas gradually pulled out from vacuum space, and oxidizing the content harmful oxidation component in exhaust gas after attracting the exhaust gas discharged from semiconductor fabrication machines and equipment throughout [ vacuum sky ].

[Claim 2] After heating the exhaust gas gradually pulled out from vacuum space after attracting the exhaust gas discharged from semiconductor fabrication machines and equipment throughout [ vacuum sky ] and oxidizing the content harmful oxidation component in exhaust gas, The semi-conductor exhaust gas damage elimination approach characterized by emitting clarification exhaust gas while collecting the wash water which carried out the spray of the shower water to processing exhaust gas, was made to carry out uptake of the solid contained in processing exhaust gas to shower water, made exhaust gas clarification, and carried out uptake of the solid.

[Claim 3] The vacuum tank for attracting the exhaust gas discharged from semiconductor fabrication machines and equipment, The heating apparatus which the exhaust gas attracted by the vacuum tank is pulled [ heating apparatus ] out gradually, is heated [ heating apparatus ], and oxidizes the oxidation injurious ingredient in exhaust gas, The shower washing section which injects shower water to the processing exhaust gas which was oxidized and generated dust, The bosh-like shower receptacle with which it is arranged under the shower washing section, and the through-hole is drilled in the center section, the funnel with which it is arranged under the bosh-like shower receptacle, and the throat hole for jet passage is formed in the center section -- with the \*\* section a funnel -- with the skirt-board-like section which was connected caudad and formed from the throat hole of the \*\* section a bosh-like shower receptacle and a funnel -- the semi-conductor exhaust gas damage elimination equipment characterized by consisting of an inhalation-of-air gap which is formed between the \*\* sections and has the closing motion means in which open air installation is possible, and a water receiving tank arranged under the skirt-board-like section.

[Claim 4] the pumping pipe which has arranged the storage pump to the water receiving tank, and was drawn from the storage pump in the semi-conductor gas damage elimination equipment of claim 2 -- the skirt-board-like section and a funnel -- the semi-conductor exhaust gas damage elimination equipment by which it is characterized [ which was connected to the shower of shower washing circles through the through-hole of a bosh-like shower receptacle at the throat hole list of the \*\* section ].

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to damage elimination of exhaust gas, and the especially harmful effective damage elimination approach and equipment of the exhaust gas for semi-conductor manufacture which has explosivity.

[0002]

[Description of the Prior Art] \*\* system gas (for example, PH<sub>3</sub>), arsenic system gas (for example, AsH<sub>3</sub>), boron system gas (for example, B-2 H<sub>6</sub>), etc. are used for the exhaust gas for semi-conductor manufacture in the silane system gas (for example, SiH<sub>4</sub> and SiH<sub>2</sub>Cl<sub>2</sub>) and venomous which have explosivity. Although it becomes exhaust gas and is discharged from equipment after supplying these special gases for semiconductor process to semiconductor fabrication machines and equipment, causing various chemical reactions within equipment and processing a semi-conductor wafer, the injurious ingredient which the unconverted gas remained in exhaust gas, and was newly generated by the reaction within equipment is contained. Therefore, it was very dangerous to carry out atmospheric-air emission of the reaction exhaust gas as it is, in the former, diluted with a lot of nitrogen gas, it is made for exhaust gas concentration to become below a lower explosive limit, and the method of mixing a lot of air and carrying out atmospheric-air emission as it is was taken the appropriate back. However, from a viewpoint of environmental protection, atmospheric-air emission passes, and is regulated, and dilution atmospheric-air emission like the former is becoming impossible.

[0003] Then, although damage elimination processing is carried out in works, and it has been recently lost if it is practice \*\*\*\*, a semi-conductor takes for being integrated highly, an air cleanliness class comes to be required, damage elimination equipment is also installed along with semiconductor fabrication machines and equipment, and a manufacture site has come to be used in a clean room. When one example of the approach is shown, two or more cartridges filled up with drugs are prepared, and carry out conduction of the exhaust gas to sequence at this, the drugs in a cartridge and the injurious ingredient in exhaust gas are made to react, a damage is eliminated, and there is the batch type approach of exchanging for a new cartridge the cartridge which it finished using. Thus, although the activity which exchanges a used cartridge for a new cartridge had to be done with batch type damage elimination equipment in the clean room, there was a serious problem of an injurious ingredient, especially dust having leaked from a used cartridge in the case of this cartridge exchange, and soiling the inside of a clean room. Moreover, by the batch type approach, the situation [ exhausting ] of a cartridge must always be grasped and there was also a problem of being complicated. Therefore, in the semi-conductor manufacture site, the running cost was also cheap and, moreover, development of not the batch type damage elimination approach but the damage elimination approach that exhaust gas can be processed stably and continuously, and its equipment was desired.

[0004]

[Problem(s) to be Solved by the Invention] A running cost is also cheap, there is and, moreover, the technical problem which this invention tends to solve has it in stable and continuous, and proposing the semi-conductor exhaust gas damage elimination approach which can be processed without soiling the interior of a room especially in the clean interior of a room, and its equipment in harmful and the dangerous semi-conductor exhaust gas which has explosivity.

[0005]

[Means for Solving the Problem] After attracting the exhaust gas discharged from \*\* semiconductor fabrication machines and equipment (1) throughout [ vacuum sky ] as shown in claim 1 in order that this invention approach may solve said technical problem, it is characterized by heating the exhaust gas gradually pulled out from \*\* vacuum space (14), and oxidizing the content harmful oxidation component in exhaust gas. Thereby, harmful and after carrying out vacuum dilution of the exhaust gas for semi-conductor manufacture which has explosivity to explosion thru/or the

minimum community of a lethal dose, the damage could be eliminated effectively.

[0006] After the approach shown in claim 2 attracts the exhaust gas discharged from \*\* semiconductor fabrication machines and equipment (1) all over vacuum space (14), \*\* After heating the exhaust gas gradually pulled out from vacuum space (14) and oxidizing the content harmful oxidation component in exhaust gas, \*\* While collecting the wash water which carried out the spray of the shower water (2) to processing exhaust gas, was made to carry out uptake of the solid contained in processing exhaust gas to shower water (2), made exhaust gas clarification, and carried out uptake of the \*\* solid, it is characterized by emitting clarification exhaust gas. Thereby, the harmful and effective damage elimination of the exhaust gas for semi-conductor manufacture which has explosivity was attained.

[0007] The semi-conductor exhaust gas damage elimination equipment shown in claim 3 is equipment for enforcing said approach. \*\* The vacuum tank for attracting the exhaust gas discharged from semiconductor fabrication machines and equipment (1) (14), \*\* The heating apparatus which the exhaust gas attracted by the vacuum tank (14) is pulled [ heating apparatus ] out gradually, is heated [ heating apparatus ], and oxidizes the oxidation injurious ingredient in exhaust gas (4), \*\* The shower washing section which injects shower water (2) to the processing exhaust gas (3b) which was oxidized and generated dust (5), \*\* The bosh-like shower receptacle with which it is arranged under the shower washing section (5), and the through-hole (6) is drilled in the center section (7), \*\* the funnel with which it is arranged under the bosh-like shower receptacle (7), and the throat hole for jet passage (8) is formed in the center section -- with the \*\* section (9) \*\* a funnel -- with the skirt-board-like section (10) which was connected caudad and formed from the throat hole (8) of the \*\* section (9) a bosh-like shower receptacle (7) and a funnel -- it is formed between the \*\* sections (9) and is characterized by consisting of an inhalation-of-air gap (12) which has the closing motion means (11) in which open air installation is possible, and a water receiving tank (13) arranged under the \*\* skirt-board-like section (10).

[0008] Moreover, if it is in claim 3, it sets to the semi-conductor gas damage elimination equipment of \*\* claim 3. \*\* The pumping pipe (22) which has arranged the storage pump (PY) to the water receiving tank (13), and was drawn from the storage pump (PY) the skirt-board-like section (10) and a funnel -- it considers as the description connected to the shower (5a) in the shower washing section (5) through the through-hole of a bosh-like shower receptacle (7) at the throat hole (8) list of the \*\* section (9). Thereby, along with a pumping pipe (22), shower water (2) can flow down the perimeter of a pumping pipe (22) in the spiral dense condition, and dust can be collected more effectively.

[0009]

[Example] Hereafter, this invention equipment is explained in full detail according to an illustration example. Drawing 1 is the whole semi-conductor production-line flow Fig. containing this invention equipment, and drawing 2 is the sectional view of this invention equipment. In drawing 1, (1) is semiconductor fabrication machines and equipment like a CVD system, and exhaust air Rhine (L) is drawn and it is connected to two sets (14) of the vacuum tanks arranged at juxtaposition, and (14'), respectively. Vacuum meter (P1) is installed for one side by each in reserve, and, as for a vacuum tank (14) and (14'), the degree of vacuum in a vacuum tank (14) (14') is checked. (15) is the inert gas feed zone which supplies inert gas like nitrogen, it connects with a vacuum tank (14) and (14') through the bulb (b1), and when the degree of vacuum in a vacuum tank (14) (14') falls and the open air trespasses upon the interior, it is used for urgent maintenance of supplying a lot of nitrogen gas to a vacuum tank (14) and (14'), and preventing explosion of suction exhaust gas.

[0010] Once a vacuum tank (exhaust air Rhine (L) drawn from 14) and (14')) enters and joins and it shunts it toward an outlet side change-over valve (K2) again, it goes into a flame arrester (16) and it joins it. Each is equipped with the check valve (18) at the closing motion valve (17) and the vacuum pump (P2) list, respectively, and a passage change can be performed now in splitting Rhine (BL1) (BL2). Splitting Rhine (BL1) is mainly used, and it is a reserve, and splitting Rhine (BL2) is used, changing, when splitting Rhine (BL1) breaks down.

[0011] A flame arrester (16) is a cooling system for backfire prevention. It connects with heating apparatus (4) and a flame arrester (exhaust air Rhine (L) drawn from 16)) is heated here. In heating apparatus (4), as shown in drawing 2, many thin conduits (19) are arranged, and while flowing the inside of a conduit (19) with the electric heat coil (not shown) \*\*\*\*(ed) by the elevated-temperature gas or the conduit (19) which raw exhaust gas (3a) flows the inside of a conduit (19), and flows the outside of a conduit (19), raw exhaust gas (3a) is heated.

[0012] Moreover, a high-pressure inert gas supply means (20), for example, high-pressure nitrogen piping, is connected to the upstream of heating apparatus (4), in the conduit (19) of heating apparatus (4), high-pressure nitrogen gas is injected intermittently and the inside of tubing (19) can be cleaned now. Moreover, it is used also as a dilution means of raw exhaust gas (3a). Heating apparatus (exhaust air Rhine (L) drawn from the down-stream edge of 4)) is connected to the shower washing section (5) of a jet scrubber (J). (30) is a bypass circuit which bypasses heating apparatus (4).

[0013] The jet scrubber (J) is constituted from a water receiving tank (13) by the shower washing section (5), the

scrubber tower (T), and the exhaust air section (H) list. The shower washing section (5) is installed on the scrubber tower (T), the shower (5a) is installed in the center of the interior, and it is made to have spouted high-pressure shower water (2) downward. (21) is the access door which can be opened and closed. Said shower washing section (5) is installed in the upper limit of a scrubber tower (T), and the bosh-like shower receptacle (7) with which the through-hole (6) is drilled in the center section is installed in the pars basilaris ossis occipitalis of the shower washing section (5). Thereby, along the perimeter of a rat tail and a pumping pipe (22), through a central through-hole (6), high-pressure shower water (2) flows caudad, and goes. Moreover, open air installation tubing with a closing motion valve (23) is installed in casing (5b) of the shower washing section (5), a closing motion valve (23a) can be opened if needed, and the open air can be incorporated now in casing (5b). When oxygen is not contained in raw exhaust gas (3a), thru/or when there are few oxygen contents, it enables it to supply oxygen by this.

[0014] the lower part of a bosh-like shower receptacle (7) -- a funnel -- the \*\* section (9) installs -- having -- \*\*\*\* -- a funnel -- the throat hole for jet passage (8) is formed in the center section of the \*\* section (9). furthermore, a funnel -- it connects caudad from the throat hole (8) of the \*\* section (9), the skirt-board-like section (10) of bottom breadth is formed, and processing exhaust gas (3b) is extracted with a throat hole (8). moreover, a bosh-like shower receptacle (7) and a funnel -- between the \*\* sections (9), the inhalation-of-air gap (12) for which the closing motion to the open air is possible is formed, and the open air is attracted and it mixes with processing exhaust gas (3a). Well-known closing motion means for air supplies (11) -- the closing motion approach prepares a closing motion door -- are adopted.

[0015] The water receiving tank (13) is installed in the lower limit of a scrubber tower (T), and the drug solution (2a) is storing water to the water receiving tank (13). The overflow pipe (24) and the feed pipe (25) are connected to the upper part of a water receiving tank (13), and drain tubing (26) is connected to the pars basilaris ossis occipitalis. the pumping pipe (22) which the storage pump (PY) is arranged at the water receiving tank (13), and was drawn from the storage pump (PY) -- the skirt-board-like section (10) and a funnel -- it has connected with the shower (5a) in the shower washing section (5) through the through-hole (6) of a bosh-like shower receptacle (7) at the throat hole (8) list of the \*\* section (9).

[0016] In the case of drawing 1, a mist separator (27) stands in a row in a scrubber tower (T), and is set up on the water receiving tank (13), and it connects with the ventilating fan (HF). Moreover, (28) is a pH meter, if the pH of the drug solution (2a) in a water receiving tank (13) is measured and there is need, will receive supply of pH adjustment liquid, such as acid liquid of an initial complement, or lye, from the drug solution service tank (29) which a pump (P3) is operated and is put side by side, and will perform pH adjustment. A fresh drug solution (2a) is supplied from a feed pipe (25) according to overflow.

[0017] It is devised so that it can mainly be used indoors, and the jet pipe (D) is connected [ the example of drawing 2 is small compared with the case of drawing 1 ] to the upper part of a scrubber tower (T), and the outlet of a jet pipe (D) is connected to the ventilating fan (HF). Installation of a pH meter and a drug solution service tank as well as drawing 1 is possible if needed. Moreover, it is also possible the thing of drawing 1 and to use it indoors.

[0018] The drug solution (2a) by which a shower is carried out is selected by the class of exhaust gas (3a), and water, the alkaline water, and acid water are used suitably. if there are various kinds of things in exhaust gas (3a) and an example is given -- a phosphine, diboron hexahydride, a silane, an arsine, hydrogen selenide, hydrogen, hydrochloric acid gas, ammonia gas, etc. -- it is -- these -- toxicity, explosivity, corrosive, and others -- it has a dangerous property.

[0019] A deer is carried out and the raw exhaust gas (3a) discharged from semiconductor fabrication machines and equipment (1) is introduced into the main vacuum tank (14) through exhaust air Rhine (L). Sufficient degree of vacuum is maintained by the inside of a vacuum tank (14), and the attracted exhaust gas is diffused and diluted within a vacuum tank (14), and if it is in the exhaust gas which contains strong toxic components, such as an arsine, a phosphine, diboron hexahydride, and hydrogen selenide, below a lower explosive limit in the exhaust gas containing explosive components, such as hydrogen, diboron hexahydride, a phosphine, and an arsine, it becomes the concentration below a lethal dose minimum community and below [ other ] the minimum community of various indexes. In addition, a vacuum tank (14) is exhausted by the vacuum pump (P2), and is made into the vacuum. Moreover, when failure occurs in the main vacuum tank (14), it prevents that the change to a reserve vacuum tank (14') is performed quickly, and a lot of nitrogen gas is supplied to the main vacuum tank (14) at coincidence, dilute the exhaust gas inside a vacuum tank (14) quickly, contact the open air, and exhaust gas explodes by the entry side selector valve (K1).

[0020] If raw exhaust gas (3a) is attracted and diluted by the main vacuum tank (14), it will be pulled out from the main vacuum tank (14) by the dilution concentration, and will connect with heating apparatus (4) through an outlet side change-over valve (K2). Splitting Rhine (BL1) is usually used, and the supply to heating apparatus (4) is supplied to heating apparatus (4), and is heated. The oxygen contained in raw exhaust gas (3a) and the reaction component in raw exhaust gas (3a) are made to oxidize here by usually containing oxygen in the form of a simple substance or a

compound with the minute amount in the raw exhaust gas (3a) discharged from semiconductor fabrication machines and equipment (1), and heating raw exhaust gas (3a) with heating apparatus (4). By this reaction, a lot of dry dust is generated, and it collects and goes in a conduit (19). A lot of dust which collected in the conduit (19) will be blown away by making high-pressure inert gas (for example, nitrogen etc.) blow off with a high-pressure inert gas supply means (20) intermittently, and will be sent into the shower washing section (5) with processing exhaust gas (3b).

[0021] The example of an oxidation-in-the-gas-phase reaction is shown below.

(1) Silane system gas When it contains, a  $\text{SiH}_4 + 2\text{O}_2 \rightarrow \text{SiO}_2(\text{dust}) + 2\text{H}_2\text{O}$  (2) halogenation silane is included and  $\text{SiH}_2\text{Cl}_2 + \text{O}_2 \rightarrow \text{SiO}_2(\text{dust}) + 2\text{HCl}$  (it neutralizes by lye) (3) phosphorus compounds are included, a  $\text{PH}_3 + 4\text{O}_2 \rightarrow \text{P}_2\text{O}_5 + 3\text{H}_2\text{O}$  (4) arsenic compound  $\text{B-2H}_6 + 3\text{O}_2 \rightarrow \text{B-2O}_3 + 3\text{H}_2\text{O}$  when it contains and an  $\text{AsH}_3 + 3\text{O}_2 \rightarrow \text{As}_2\text{O}_3 + 3\text{H}_2\text{O}$  (5) boron compound is included [0022] Thus, it oxidizes, and the processing exhaust gas (3b) which contains dust in large quantities goes into the shower washing section (5), and uptake of the dust is carried out to shower spraying (5) by the high-pressure shower (5a). High-pressure shower water (5) is injected toward the bosh-like shower receptacle (7) with which the through-hole (6) is drilled in the center section, raises the rat tail rate of flow by the through-hole (6), and is passed. At this time, the contact opportunity of shower injection (5) and dust increases, and uptake is carried out effectively. In this example, when the pumping pipe (22) is setting up in the center, centering on a pumping pipe (22), high-pressure shower water (5) becomes a whirl, and it passes through the perimeter, and goes, and it is high-density and said contact is measured.

[0023] Shower spraying (5) which passed the through-hole (6), and the washed exhaust gas (3c) pass a throat hole (8), where a transit rate is gathered, also in this part, the contact opportunity of shower spraying (5) and dust increases, and washing of exhaust gas (3c) advances further. When the concentration of exhaust gas (3b) is high, atmospheric-air disconnection of the closing motion means (11) is carried out, the open air is attracted from an inhalation-of-air gap (12), a lot of open air is mixed, high concentration exhaust gas (3b) is diluted, a throat hole (8) is passed continuously, and it is introduced into the skirt-board-like section (10).

[0024] Since the skirt-board-like section (10) has spread so that it goes to the bottom, a drop coalesces, and it grows up to be a bigger drop, and goes into a water receiving tank (13) at the same time the exhaust gas rate of flow falls. The drug solution (2a) in a water receiving tank (13) is pumped up with a storage pump (22), and high-pressure spraying is again carried out in a shower (5a). Thus, since a drug solution (2a) is used circulating, the amount of dust and a fusibility injurious ingredient increase gradually, and a drug solution (2a) becomes dirty and goes. Then, only tales doses supply a new drug solution (2a) at the same time it discharges some old drug solutions (2a) through an overflow pipe (24). Thus, renewal of sequential of the drug solution (2a) is carried out.

[0025] Moreover, since it has passed through the center of the skirt-board-like section (10) in the through-hole (6) and the throat hole (8) list as mentioned above, centering on a pumping pipe (22), pressure spraying (5) will pass through the perimeter in the state of a dense eddy, and, as for a pumping pipe (22), will heighten the uptake effectiveness of dust as mentioned above.

[0026] In addition, when minute amount oxygen is not contained in raw exhaust gas (3a), in order to promote oxidation of raw exhaust gas (3a), the closing motion valve for open air installation (23a) will be opened, the open air will be introduced in casing (5b) of the shower washing section (5), and oxidation will be promoted within casing (5b). In this case, it cannot be overemphasized that it must dilute with inert gas to the lower explosive limit of raw exhaust gas (3a).

[0027] Thus, the processed exhaust gas (3a) turns into clarification exhaust gas (3c), and atmospheric-air emission is carried out by the exhaust air section (H) out of doors. The above can perform offgas treatment continuously. If it miniaturizes like drawing 2 especially, it can be used for semiconductor fabrication machines and equipment (1) by 1 to 1 correspondence in a clean room.

[0028]

[Effect of the Invention] Since this invention approach attracts the semi-conductor exhaust gas discharged from semiconductor fabrication machines and equipment throughout [ vacuum sky ] as above-mentioned, according to a degree of vacuum, exhaust gas concentration is diluted momentarily and turns into concentration below a lower explosive limit and the minimum community of a lethal dose minimum community and other indexes. So, it is not necessary to dilute exhaust gas with a lot of nitrogen gas like before, the costs of nitrogen gas can be reduced, and reduction of a running cost can be aimed at. Furthermore, since the exhaust gas diluted with this vacuum space is pulled out gradually and heating oxidation is carried out, an injurious ingredient will be removed in this phase and can carry out damage elimination processing effective as a whole to insurance. [0029] Moreover, since the exhaust gas which was gradually pulled out from vacuum space in claim 2 in addition to this is heated, the content harmful oxidation component in exhaust gas is oxidized, an injurious ingredient is removed in this phase and a shower is carried out continuously, uptake of all the dust contained in processing exhaust gas is carried out to shower water, and it serves as

clarification air. thus -- since it can process continuously -- the batch type of the conventional example -- there is an advantage that the inside of a clean room can always be maintained at clarification so that it may not say that a used cartridge must be exchanged in a clean room like.

[0030] moreover, with the semi-conductor exhaust gas damage elimination equipment shown in claim 3 Since the exhaust gas discharged from semiconductor fabrication machines and equipment as mentioned above is attracted throughout [ vacuum sky ] According to a degree of vacuum, exhaust gas concentration will be momentarily diluted by the concentration below a lower explosive limit and the minimum community of a lethal dose minimum community and other indexes. Since it has heating apparatus at degree process, it not only can aim at reduction of a running cost by saving of nitrogen gas, but Since can heat safely the exhaust gas taken out from a vacuum tank in the state of dilution, the injurious ingredient in exhaust gas can be oxidized, it can defang and it has the shower washing section further, the dust generated by oxidation reaction is removable. in addition, the funnel arranged under the bosh-like shower receptacle of the lower part of the shower washing section, and the bosh-like shower receptacle -- since a shower spraying style can be extracted over 2 times in the \*\* section, contact of dust and spraying is performed efficiently, uptake of the dust is carried out effectively, and a high exhaust gas cleaning effect can be acquired. furthermore, a bosh-like shower receptacle and a funnel -- since the inhalation-of-air gap is formed between the \*\* sections, high concentration exhaust gas can be diluted if needed, and said this invention approach can be enforced.

[0031] moreover, the pumping pipe drawn from the storage pump in a water receiving tank if it was in claim 3 -- the skirt-board-like section and a funnel, since it has connected with the shower of shower washing circles through the through-hole of a bosh-like shower receptacle at the throat hole list of the \*\* section Since it becomes high density, and it flows down and it is extracted with a through-hole or a throat hole, circling in the perimeter of a pumping pipe, contact to dust is performed effectively, and the injected shower water has the advantage that the cleaning effect of exhaust gas can be heightened.

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TECHNICAL FIELD

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PRIOR ART

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EFFECT OF THE INVENTION

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[Effect of the Invention] Since this invention approach attracts the semi-conductor exhaust gas discharged from semiconductor fabrication machines and equipment throughout [ vacuum sky ] as above-mentioned, according to a degree of vacuum, exhaust gas concentration is diluted momentarily and turns into concentration below a lower explosive limit and the minimum community of a lethal dose minimum community and other indexes. So, it is not necessary to dilute exhaust gas with a lot of nitrogen gas like before, the costs of nitrogen gas can be reduced, and reduction of a running cost can be aimed at. Furthermore, since the exhaust gas diluted with this vacuum space is pulled out gradually and heating oxidation is carried out, an injurious ingredient will be removed in this phase and can carry out damage elimination processing effective as a whole to insurance. [0029] Moreover, since the exhaust gas which was gradually pulled out from vacuum space in claim 2 in addition to this is heated, the content harmful oxidation component in exhaust gas is oxidized, an injurious ingredient is removed in this phase and a shower is carried out continuously, uptake of all the dust contained in processing exhaust gas is carried out to shower water, and it serves as clarification air. thus -- since it can process continuously -- the batch type of the conventional example -- there is an advantage that the inside of a clean room can always be maintained at clarification so that it may not say that a used cartridge must be exchanged in a clean room like.

[0030] moreover, with the semi-conductor exhaust gas damage elimination equipment shown in claim 3 Since the exhaust gas discharged from semiconductor fabrication machines and equipment as mentioned above is attracted throughout [ vacuum sky ] According to a degree of vacuum, exhaust gas concentration will be momentarily diluted by the concentration below a lower explosive limit and the minimum community of a lethal dose minimum community and other indexes. Since it has heating apparatus at degree process, it not only can aim at reduction of a running cost by saving of nitrogen gas, but Since can heat safely the exhaust gas taken out from a vacuum tank in the state of dilution, the injurious ingredient in exhaust gas can be oxidized, it can defang and it has the shower washing section further, the dust generated by oxidation reaction is removable. in addition, the funnel arranged under the bosh-like shower receptacle of the lower part of the shower washing section, and the bosh-like shower receptacle -- since a shower spraying style can be extracted over 2 times in the \*\* section, contact of dust and spraying is performed efficiently, uptake of the dust is carried out effectively, and a high exhaust gas cleaning effect can be acquired. furthermore, a bosh-like shower receptacle and a funnel -- since the inhalation-of-air gap is formed between the \*\* sections, high concentration exhaust gas can be diluted if needed, and said this invention approach can be enforced.

[0031] moreover, the pumping pipe drawn from the storage pump in a water receiving tank if it was in claim 3 -- the skirt-board-like section and a funnel, since it has connected with the shower of shower washing circles through the through-hole of a bosh-like shower receptacle at the throat hole list of the \*\* section Since it becomes high density, and it flows down and it is extracted with a through-hole or a throat hole, circling in the perimeter of a pumping pipe, contact to dust is performed effectively, and the injected shower water has the advantage that the cleaning effect of exhaust gas can be heightened.

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[Translation done.]

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] A running cost is also cheap, there is and, moreover, the technical problem which this invention tends to solve has it in stable and continuous, and proposing the semi-conductor exhaust gas damage elimination approach which can be processed without soiling the interior of a room especially in the clean interior of a room, and its equipment in harmful and the dangerous semi-conductor exhaust gas which has explosivity.

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MEANS

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[Means for Solving the Problem] After attracting the exhaust gas discharged from \*\* semiconductor fabrication machines and equipment (1) throughout [ vacuum sky ] as shown in claim 1 in order that this invention approach may solve said technical problem, it is characterized by heating the exhaust gas gradually pulled out from \*\* vacuum space (14), and oxidizing the content harmful oxidation component in exhaust gas. Thereby, harmful and after carrying out vacuum dilution of the exhaust gas for semi-conductor manufacture which has explosivity to explosion thru/or the minimum community of a lethal dose, the damage could be eliminated effectively.

[0006] After the approach shown in claim 2 attracts the exhaust gas discharged from \*\* semiconductor fabrication machines and equipment (1) all over vacuum space (14), \*\* After heating the exhaust gas gradually pulled out from vacuum space (14) and oxidizing the content harmful oxidation component in exhaust gas, \*\* While collecting the wash water which carried out the spray of the shower water (2) to processing exhaust gas, was made to carry out uptake of the solid contained in processing exhaust gas to shower water (2), made exhaust gas clarification, and carried out uptake of the \*\* solid, it is characterized by emitting clarification exhaust gas. Thereby, the harmful and effective damage elimination of the exhaust gas for semi-conductor manufacture which has explosivity was attained.

[0007] The semi-conductor exhaust gas damage elimination equipment shown in claim 3 is equipment for enforcing said approach. \*\* The vacuum tank for attracting the exhaust gas discharged from semiconductor fabrication machines and equipment (1) (14), \*\* The heating apparatus which the exhaust gas attracted by the vacuum tank (14) is pulled [ heating apparatus ] out gradually, is heated [ heating apparatus ], and oxidizes the oxidation injurious ingredient in exhaust gas (4), \*\* The shower washing section which injects shower water (2) to the processing exhaust gas (3b) which was oxidized and generated dust (5), \*\* The bosh-like shower receptacle with which it is arranged under the shower washing section (5), and the through-hole (6) is drilled in the center section (7), \*\* the funnel with which it is arranged under the bosh-like shower receptacle (7), and the throat hole for jet passage (8) is formed in the center section -- with the \*\* section (9) \*\* a funnel -- with the skirt-board-like section (10) which was connected caudad and formed from the throat hole (8) of the \*\* section (9) a bosh-like shower receptacle (7) and a funnel -- it is formed between the \*\* sections (9) and is characterized by consisting of an inhalation-of-air gap (12) which has the closing motion means (11) in which open air installation is possible, and a water receiving tank (13) arranged under the \*\* skirt-board-like section (10).

[0008] Moreover, if it is in claim 3, it sets to the semi-conductor gas damage elimination equipment of \*\* claim 3. \*\* The pumping pipe (22) which has arranged the storage pump (PY) to the water receiving tank (13), and was drawn from the storage pump (PY) the skirt-board-like section (10) and a funnel -- it considers as the description connected to the shower (5a) in the shower washing section (5) through the through-hole of a bosh-like shower receptacle (7) at the throat hole (8) list of the \*\* section (9). Thereby, along with a pumping pipe (22), shower water (2) can flow down the perimeter of a pumping pipe (22) in the spiral dense condition, and dust can be collected more effectively.

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## EXAMPLE

[Example] Hereafter, this invention equipment is explained in full detail according to an illustration example. Drawing 1 is the whole semi-conductor production-line flow Fig. containing this invention equipment, and drawing 2 is the sectional view of this invention equipment. In drawing 1, (1) is semiconductor fabrication machines and equipment like a CVD system, and exhaust air Rhine (L) is drawn and it is connected to two sets (14) of the vacuum tanks arranged at juxtaposition, and (14'), respectively. Vacuum meter (P1) is installed for one side by each in reserve, and, as for a vacuum tank (14) and (14'), the degree of vacuum in a vacuum tank (14) (14') is checked. (15) is the inert gas feed zone which supplies inert gas like nitrogen, it connects with a vacuum tank (14) and (14') through the bulb (b1), and when the degree of vacuum in a vacuum tank (14) (14') falls and the open air trespasses upon the interior, it is used for urgent maintenance of supplying a lot of nitrogen gas to a vacuum tank (14) and (14'), and preventing explosion of suction exhaust gas.

[0010] Once a vacuum tank (exhaust air Rhine (L) drawn from 14) and (14')) enters and joins and it shunts it toward an outlet side change-over valve (K2) again, it goes into a flame arrester (16) and it joins it. Each is equipped with the check valve (18) at the closing motion valve (17) and the vacuum pump (P2) list, respectively, and a passage change can be performed now in splitting Rhine (BL1) (BL2). Splitting Rhine (BL1) is mainly used, and it is a reserve, and splitting Rhine (BL2) is used, changing, when splitting Rhine (BL1) breaks down.

[0011] A flame arrester (16) is a cooling system for backfire prevention. It connects with heating apparatus (4) and a flame arrester (exhaust air Rhine (L) drawn from 16)) is heated here. In heating apparatus (4), as shown in drawing 2, many thin conduits (19) are arranged, and while flowing the inside of a conduit (19) with the electric heat coil (not shown) \*\*\*\*(ed) by the elevated-temperature gas or the conduit (19) which raw exhaust gas (3a) flows the inside of a conduit (19), and flows the outside of a conduit (19), raw exhaust gas (3a) is heated.

[0012] Moreover, a high-pressure inert gas supply means (20), for example, high-pressure nitrogen piping, is connected to the upstream of heating apparatus (4), in the conduit (19) of heating apparatus (4), high-pressure nitrogen gas is injected intermittently and the inside of tubing (19) can be cleaned now. Moreover, it is used also as a dilution means of raw exhaust gas (3a). Heating apparatus (exhaust air Rhine (L) drawn from the down-stream edge of 4)) is connected to the shower washing section (5) of a jet scrubber (J). (30) is a bypass circuit which bypasses heating apparatus (4).

[0013] The jet scrubber (J) is constituted from a water receiving tank (13) by the shower washing section (5), the scrubber tower (T), and the exhaust air section (H) list. The shower washing section (5) is installed on the scrubber tower (T), the shower (5a) is installed in the center of the interior, and it is made to have spouted high-pressure shower water (2) downward. (21) is the access door which can be opened and closed. Said shower washing section (5) is installed in the upper limit of a scrubber tower (T), and the bosh-like shower receptacle (7) with which the through-hole (6) is drilled in the center section is installed in the pars basilaris ossis occipitalis of the shower washing section (5). Thereby, along the perimeter of a rat tail and a pumping pipe (22), through a central through-hole (6), high-pressure shower water (2) flows caudad, and goes. Moreover, open air installation tubing with a closing motion valve (23) is installed in casing (5b) of the shower washing section (5), a closing motion valve (23a) can be opened if needed, and the open air can be incorporated now in casing (5b). When oxygen is not contained in raw exhaust gas (3a), thru/or when there are few oxygen contents, it enables it to supply oxygen by this.

[0014] the lower part of a bosh-like shower receptacle (7) -- a funnel -- the \*\* section (9) installs -- having -- \*\*\*\* -- a funnel -- the throat hole for jet passage (8) is formed in the center section of the \*\* section (9). furthermore, a funnel -- it connects caudad from the throat hole (8) of the \*\* section (9), the skirt-board-like section (10) of bottom breadth is formed, and processing exhaust gas (3b) is extracted with a throat hole (8). moreover, a bosh-like shower receptacle (7) and a funnel -- between the \*\* sections (9), the inhalation-of-air gap (12) for which the closing motion to the open air is possible is formed, and the open air is attracted and it mixes with processing exhaust gas (3a). Well-known closing

motion means for air supplies (11) -- the closing motion approach prepares a closing motion door -- are adopted.

[0015] The water receiving tank (13) is installed in the lower limit of a scrubber tower (T), and the drug solution (2a) is storing water to the water receiving tank (13). The overflow pipe (24) and the feed pipe (25) are connected to the upper part of a water receiving tank (13), and drain tubing (26) is connected to the pars basilaris ossis occipitalis. the pumping pipe (22) which the storage pump (PY) is arranged at the water receiving tank (13), and was drawn from the storage pump (PY) -- the skirt-board-like section (10) and a funnel -- it has connected with the shower (5a) in the shower washing section (5) through the through-hole (6) of a bosh-like shower receptacle (7) at the throat hole (8) list of the \*\* section (9).

[0016] In the case of drawing 1, a mist separator (27) stands in a row in a scrubber tower (T), and is set up on the water receiving tank (13), and it connects with the ventilating fan (HF). Moreover, (28) is a pH meter, if the pH of the drug solution (2a) in a water receiving tank (13) is measured and there is need, will receive supply of pH adjustment liquid, such as acid liquid of an initial complement, or lye, from the drug solution service tank (29) which a pump (P3) is operated and is put side by side, and will perform pH adjustment. A fresh drug solution (2a) is supplied from a feed pipe (25) according to overflow.

[0017] It is devised so that it can mainly be used indoors, and the jet pipe (D) is connected [ the example of drawing 2 is small compared with the case of drawing 1 ] to the upper part of a scrubber tower (T), and the outlet of a jet pipe (D) is connected to the ventilating fan (HF). Installation of a pH meter and a drug solution service tank as well as drawing 1 is possible if needed. Moreover, it is also possible the thing of drawing 1 and to use it indoors.

[0018] The drug solution (2a) by which a shower is carried out is selected by the class of exhaust gas (3a), and water, the alkaline water, and acid water are used suitably. if there are various kinds of things in exhaust gas (3a) and an example is given -- a phosphine, diboron hexahydride, a silane, an arsine, hydrogen selenide, hydrogen, hydrochloric acid gas, ammonia gas, etc. -- it is -- these -- toxicity, explosivity, corrosive, and others -- it has a dangerous property.

[0019] A deer is carried out and the raw exhaust gas (3a) discharged from semiconductor fabrication machines and equipment (1) is introduced into the main vacuum tank (14) through exhaust air Rhine (L). Sufficient degree of vacuum is maintained by the inside of a vacuum tank (14), and the attracted exhaust gas is diffused and diluted within a vacuum tank (14), and if it is in the exhaust gas which contains strong toxic components, such as an arsine, a phosphine, diboron hexahydride, and hydrogen selenide, below a lower explosive limit in the exhaust gas containing explosive components, such as hydrogen, diboron hexahydride, a phosphine, and an arsine, it becomes the concentration below a lethal dose minimum community and below [ other ] the minimum community of various indexes. In addition, a vacuum tank (14) is exhausted by the vacuum pump (P2), and is made into the vacuum. Moreover, when failure occurs in the main vacuum tank (14), it prevents that the change to a reserve vacuum tank (14') is performed quickly, and a lot of nitrogen gas is supplied to the main vacuum tank (14) at coincidence, dilute the exhaust gas inside a vacuum tank (14) quickly, contact the open air, and exhaust gas explodes by the entry side selector valve (K1).

[0020] If raw exhaust gas (3a) is attracted and diluted by the main vacuum tank (14), it will be pulled out from the main vacuum tank (14) by the dilution concentration, and will connect with heating apparatus (4) through an outlet side change-over valve (K2). Splitting Rhine (BL1) is usually used, and the supply to heating apparatus (4) is supplied to heating apparatus (4), and is heated. The oxygen contained in raw exhaust gas (3a) and the reaction component in raw exhaust gas (3a) are made to oxidize here by usually containing oxygen in the form of a simple substance or a compound with the minute amount in the raw exhaust gas (3a) discharged from semiconductor fabrication machines and equipment (1), and heating raw exhaust gas (3a) with heating apparatus (4). By this reaction, a lot of dry dust is generated, and it collects and goes in a conduit (19). A lot of dust which collected in the conduit (19) will be blown away by making high-pressure inert gas (for example, nitrogen etc.) blow off with a high-pressure inert gas supply means (20) intermittently, and will be sent into the shower washing section (5) with processing exhaust gas (3b).

[0021] The example of an oxidation-in-the-gas-phase reaction is shown below.

(1) Silane system gas When it contains, a  $\text{SiH}_4 + 2\text{O}_2 \rightarrow \text{SiO}_2(\text{dust}) + 2\text{H}_2\text{O}$  (2) halogenation silane is included and  $\text{SiH}_2\text{Cl}_2 + \text{O}_2 \rightarrow \text{SiO}_2(\text{dust}) + 2\text{HCl}$  (it neutralizes by lye) (3) phosphorus compounds are included, a  $\text{PH}_3 + 4\text{O}_2 \rightarrow \text{P}_2\text{O}_5 + 3\text{H}_2\text{O}$  (4) arsenic compound  $\text{B-2H}_6 + 3\text{O}_2 \rightarrow \text{B-2O}_3 + 3\text{H}_2\text{O}$  when it contains and an  $\text{AsH}_3 + 3\text{O}_2 \rightarrow \text{As}_2\text{O}_3 + 3\text{H}_2\text{O}$  (5) boron compound is included [0022] Thus, it oxidizes, and the processing exhaust gas (3b) which contains dust in

large quantities goes into the shower washing section (5), and uptake of the dust is carried out to shower spraying (5) by the high-pressure shower (5a). High-pressure shower water (5) is injected toward the bosh-like shower receptacle (7) with which the through-hole (6) is drilled in the center section, raises the rat tail rate of flow by the through-hole (6), and is passed. At this time, the contact opportunity of shower injection (5) and dust increases, and uptake is carried out effectively. In this example, when the pumping pipe (22) is setting up in the center, centering on a pumping pipe (22), high-pressure shower water (5) becomes a whirl, and it passes through the perimeter, and goes, and it is high-density

and said contact is measured.

[0023] Shower spraying (5) which passed the through-hole (6), and the washed exhaust gas (3c) pass a throat hole (8), where a transit rate is gathered, also in this part, the contact opportunity of shower spraying (5) and dust increases, and washing of exhaust gas (3c) advances further. When the concentration of exhaust gas (3b) is high, atmospheric-air disconnection of the closing motion means (11) is carried out, the open air is attracted from an inhalation-of-air gap (12), a lot of open air is mixed, high concentration exhaust gas (3b) is diluted, a throat hole (8) is passed continuously, and it is introduced into the skirt-board-like section (10).

[0024] Since the skirt-board-like section (10) has spread so that it goes to the bottom, a drop coalesces, and it grows up to be a bigger drop, and goes into a water receiving tank (13) at the same time the exhaust gas rate of flow falls. The drug solution (2a) in a water receiving tank (13) is pumped up with a storage pump (22), and high-pressure spraying is again carried out in a shower (5a). Thus, since a drug solution (2a) is used circulating, the amount of dust and a fusibility injurious ingredient increase gradually, and a drug solution (2a) becomes dirty and goes. Then, only tales doses supply a new drug solution (2a) at the same time it discharges some old drug solutions (2a) through an overflow pipe (24). Thus, renewal of sequential of the drug solution (2a) is carried out.

[0025] Moreover, since it has passed through the center of the skirt-board-like section (10) in the through-hole (6) and the throat hole (8) list as mentioned above, centering on a pumping pipe (22), pressure spraying (5) will pass through the perimeter in the state of a dense eddy, and, as for a pumping pipe (22), will heighten the uptake effectiveness of dust as mentioned above.

[0026] In addition, when minute amount oxygen is not contained in raw exhaust gas (3a), in order to promote oxidation of raw exhaust gas (3a), the closing motion valve for open air installation (23a) will be opened, the open air will be introduced in casing (5b) of the shower washing section (5), and oxidation will be promoted within casing (5b). In this case, it cannot be overemphasized that it must dilute with inert gas to the lower explosive limit of raw exhaust gas (3a).

[0027] Thus, the processed exhaust gas (3a) turns into clarification exhaust gas (3c), and atmospheric-air emission is carried out by the exhaust air section (H) out of doors. The above can perform offgas treatment continuously. If it miniaturizes like drawing 2 especially, it can be used for semiconductor fabrication machines and equipment (1) by 1 to 1 correspondence in a clean room.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The flow chart of the 1st example of this invention equipment

[Drawing 2] The flow chart of the 2nd example of this invention equipment

[Drawing 3] The sectional view which crosses the pumping pipe and the skirt-board section in this invention

[Description of Notations]

- (1) -- Semiconductor fabrication machines and equipment (2) -- Shower water
- (3) -- Exhaust gas (4) -- Heating apparatus
- (5) -- Shower washing section (6) -- Through-hole
- (7) -- Bosh-like shower receptacle (8) -- Throat hole
- (9) -- a funnel -- the \*\* section The (10) -- SUKADO-like section
- (11) -- Closing motion means (12) -- Inhalation-of-air gap
- (13) -- Water receiving tank (14) -- Vacuum tank
- (20) -- High-pressure inert gas supply means

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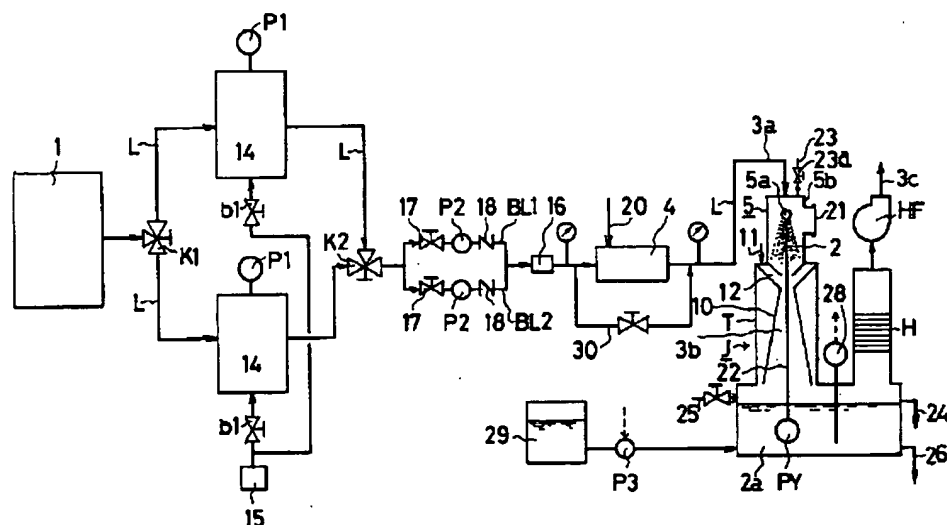
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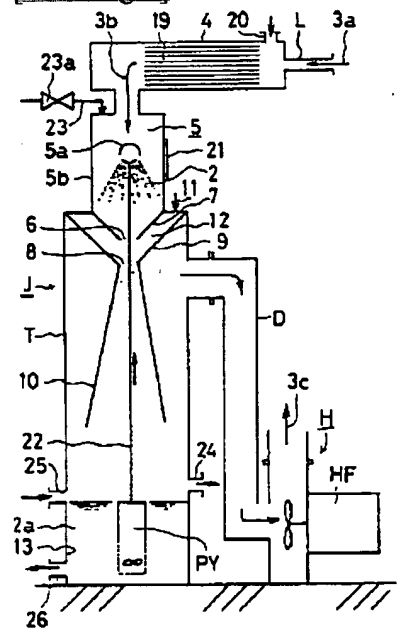
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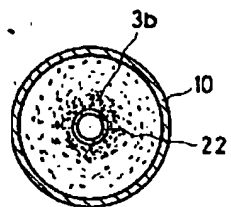
[Drawing 1]



[Drawing 2]



[Drawing 3]



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